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- Published:**
- with international search report
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
 - with (an) indication(s) in relation to deposited biological material furnished under Rule 13bis separately from the description
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- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: ALDEHYDE DEHYDROGENASE GENE

(57) Abstract: The present invention relates to a DNA which encodes aldehyde dehydrogenase (SNDH), an expression vector containing the DNA and recombinant organisms containing said DNA. Furthermore, the present invention concerns a process for producing recombinant aldehyde dehydrogenase protein and a process for producing L-ascorbic acid (vitamin C) and/or 2-keto-L-gulonic acid (2-KGA) from L-sorbose by using the recombinant aldehyde dehydrogenase protein or recombinant organisms containing the expression vector. Also provided is a process for the production of 2-KGA with a microorganism in which the gene encoding said aldehyde dehydrogenase is disrupted.

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference Case 21424	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/EP 03/10498	International filing date (day/month/year) 22/09/2003	(Earliest) Priority Date (day/month/year) 27/09/2002
Applicant DSM IP ASSETS B.V.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 6 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the International search was carried out on the basis of the International application in the language in which it was filed, unless otherwise indicated under this item.

☐ the International search was carried out on the basis of a translation of the International application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the International application, the International search was carried out on the basis of the sequence listing:

☒ contained in the International application in written form.

☒ filed together with the International application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☒ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the International application as filed has been furnished.

☒ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☒ None of the figures.

INTERNATIONAL SEARCH REPORT

PCT/EP 03/10498

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The present invention relates to a DNA which encodes aldehyde dehydrogenase (SNDH), an expression vector containing the DNA and recombinant organisms containing said DNA. Furthermore, the present invention concerns a process for producing recombinant aldehyde dehydrogenase protein and a process for producing L-ascorbic acid (vitamin C) and/or 2-keto-L-gulonic acid (2-KGA) from L-sorbose by using the recombinant aldehyde dehydrogenase protein or recombinant organisms containing the expression vector. Also provided is a process for the production of 2-KGA with a microorganism in which the gene encoding said aldehyde dehydrogenase is disrupted.

INTERNATIONAL SEARCH REPORT

International Application No.

EP 03/10498

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C12N9/04 C12N15/52 C12N5/10 C12P7/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C12N C12P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal, EMBL, BIOSIS, WPI Data, SEQUENCE SEARCH, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SAITO Y ET AL: "Direct fermentation of 2-Keto-L-gulonic acid in recombinant <i>Gluconobacter oxydans</i> " BIOTECHNOLOGY AND BIOENGINEERING. INCLUDING: SYMPOSIUM BIOTECHNOLOGY IN ENERGY PRODUCTION AND CONSERVATION, JOHN WILEY & SONS. NEW YORK, US, vol. 58, no. 2-3, 20 April 1998 (1998-04-20), pages 309-315, XP002204789 ISSN: 0006-3592 figure 4 ----- -/-	1-14

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

31 March 2004

Date of mailing of the international search report

16/04/2004

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INTERNATIONAL SEARCH REPORT

International Application No

EP 03/10498

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SAITO Y ET AL: "CLONING OF GENES CODING FOR L-SORBOSE AND L-SORBOSONE DEHYDROGENASES FROM GLUCONOBACTER OXYDANS AND MICROBIAL PRODUCTION OF 2-KETO-L-GULONATE, A PRECURSOR OF L-ASCORBIC ACID, IN A RECOMBINANT G. OXYDANS STRAIN" APPLIED AND ENVIRONMENTAL MICROBIOLOGY, WASHINGTON,DC, US, vol. 63, no. 2, 1997, pages 454-460, XP000886144 ISSN: 0099-2240 the whole document	1-14
X	HOSHINO T ET AL: "ISOLATION AND CHARACTERIZATION OF NADP-DEPENDENT L SORBOSONE DEHYDROGENASE FROM GLUCONOBACTER-MELANOGENUS UV10" AGRICULTURAL AND BIOLOGICAL CHEMISTRY, vol. 55, no. 3, 1991, pages 665-670, XP002275642 ISSN: 0002-1369 the whole document	1-14
X	US 5 437 989 A (ASAKURA AKIRA ET AL) 1 August 1995 (1995-08-01) claim 1; examples 1-3	1-14
X	ASAKURA A ET AL: "ISOLATION AND CHARACTERIZATION OF A NEW QUINOPROTEIN DEHYDROGENASE, L-SORBOSE/L-SORBOSONE DEHYDROGENASE" BIOSCIENCE BIOTECHNOLOGY BIOCHEMISTRY, JAPAN SOC. FOR BIOSCIENCE, BIOTECHNOLOGY AND AGROCHEM. TOKYO, JP, vol. 63, no. 1, January 1999 (1999-01), pages 46-53, XP001085040 ISSN: 0916-8451 the whole document	1-14
X	EP 0 373 181 A (HOFFMANN LA ROCHE) 20 June 1990 (1990-06-20) the whole document	1-14
X	EP 0 790 301 A (HOFFMANN LA ROCHE) 20 August 1997 (1997-08-20) the whole document	1-14
A	WO 02 34919 A (HOFFMANN LA ROCHE ; ROCHE DIAGNOSTICS GMBH (DE)) 2 May 2002 (2002-05-02) SEQ ID NOs 24, 25	

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/EP 03/10498

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2002 125689 A (HAYADE KOJI) 8 May 2002 (2002-05-08) SEQ ID NO:1	
A	<p>-----</p> <p>HANCOCK R D ET AL: "Biotechnological approaches for l-ascorbic acid production" TRENDS IN BIOTECHNOLOGY, ELSEVIER PUBLICATIONS, CAMBRIDGE, GB, vol. 20, no. 7, 1 July 2002 (2002-07-01), pages 299-305, XP004361398 ISSN: 0167-7799 the whole document</p> <p>-----</p>	

INTERNATIONAL SEARCH REPORT

International Application No

EP 03/10498

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5437989	A	01-08-1995	AT 224949 T	15-10-2002
			DE 69332331 D1	31-10-2002
			DE 69332331 T2	22-05-2003
			DK 606621 T3	06-01-2003
			EP 0606621 A2	20-07-1994
			ES 2181681 T3	01-03-2003
			JP 7000182 A	06-01-1995
			US 5932463 A	03-08-1999
			US 5916785 A	29-06-1999
EP 0373181	A	20-06-1990	DE 68924761 D1	14-12-1995
			DE 68924761 T2	04-04-1996
			DK 454689 A	14-09-1989
			EP 0373181 A1	20-06-1990
			US 5352599 A	04-10-1994
			AT 130030 T	15-11-1995
			WO 8906688 A2	27-07-1989
			JP 2799380 B2	17-09-1998
			JP 3500844 T	28-02-1991
EP 0790301	A	20-08-1997	EP 0790301 A2	20-08-1997
			AT 231183 T	15-02-2003
			CN 1171441 A , B	28-01-1998
			DE 69718360 D1	20-02-2003
			DE 69718360 T2	16-10-2003
			DK 790301 T3	05-05-2003
			ES 2188808 T3	01-07-2003
			ID 15955 A	21-08-1997
			JP 9224660 A	02-09-1997
			US 5776742 A	07-07-1998
WO 0234919	A	02-05-2002	AU 1596602 A	06-05-2002
			BR 0114962 A	28-10-2003
			CA 2427029 A1	02-05-2002
			WO 0234919 A1	02-05-2002
			EP 1332216 A1	06-08-2003
			US 2003104595 A1	05-06-2003
			US 2004005683 A1	08-01-2004
JP 2002125689	A	08-05-2002	NONE	